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ON THE
DEFINITION OF GEOGRAPHY
AS A SCIENCE,
AND ON
THE CONCEPTION AND DESCRIPTION OF
THE EARTH AS AN ORGANISM.

By J. BATALHA-REIS.

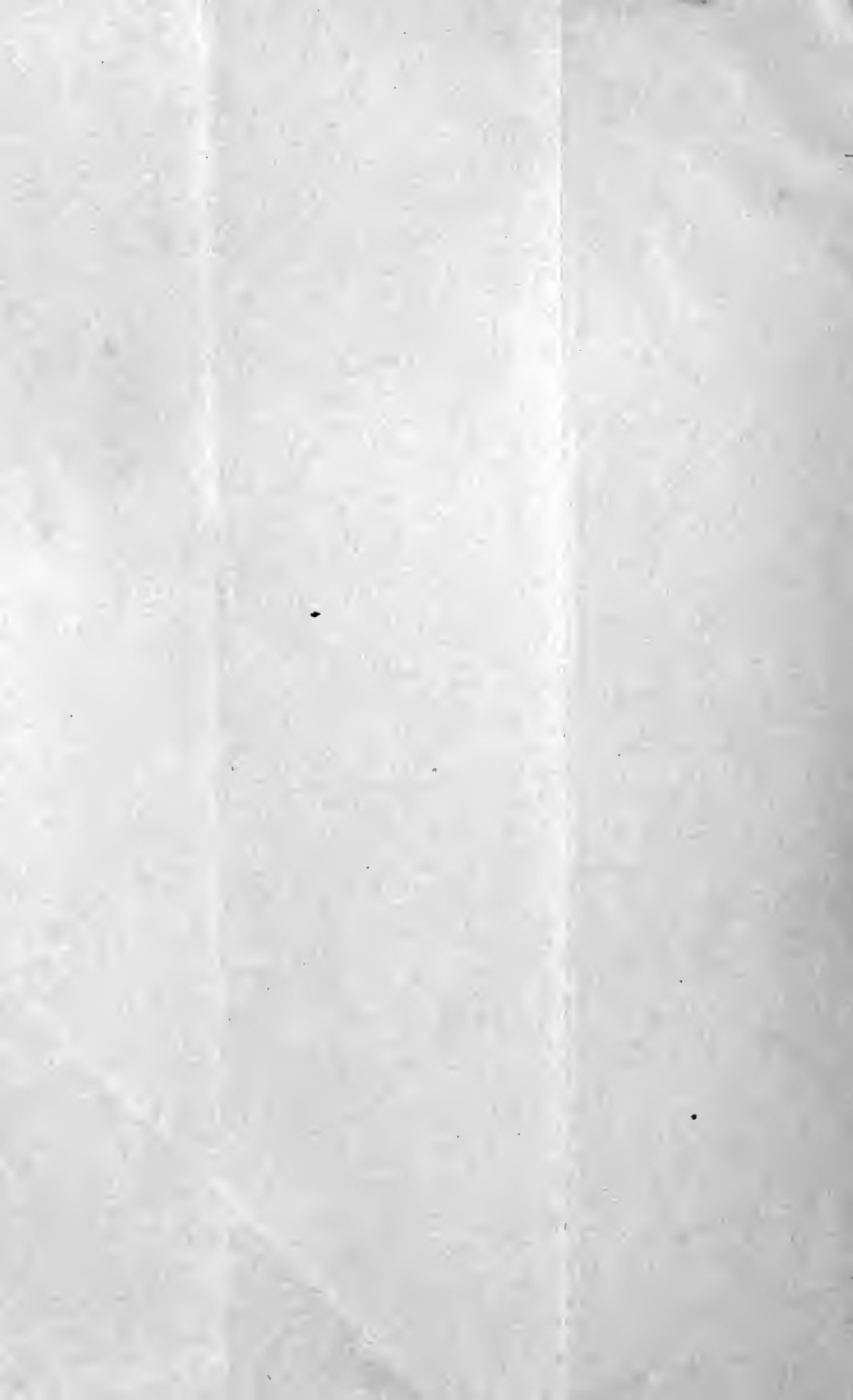
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ON THE
DEFINITION OF GEOGRAPHY AS A SCIENCE,
AND ON THE CONCEPTION AND DESCRIPTION
OF THE EARTH AS AN ORGANISM.

By J. BATALHA-REIS.

In this paper I propose briefly to indicate what, in my opinion, Geography requires to become a science—a rather limited science if it remains in its pure condition, a vast and comprehensive science if it consciously accepts the natural, fertile, and inevitable association with Geology.

In these words, the opinion is implied that Geography cannot, at the present moment, be considered as a science.*

I.

Geography is the description of the Earth, that is to say, the description of the different beings in relation to Earth; therefore, the description of the place which they occupy on it, or their occurrence and distribution thereon.

Whenever so-called geologists describe the distribution on the Earth of archæan, palæozoic, mesozoic, or cainozoic rocks, they do geographical work; whenever botanists describe the floras, or distribution of plants, on the Earth, they do geographical work; whenever zoologists describe the faunas, or distribution of animals, on the Earth, they do geographical work, as well as whenever geographers describe the distribution of continents and islands elevated out of the waters, or describe the mountains rising over them, or the water expanses and currents.

But whenever so-called geographers study and describe the constitution of a continent, an island, or a mountain, the successive transformations through which they have been or are passing, the denudations they are undergoing, the way in which new lands are being formed out

* Nor do Geographers think it very urgent to make one out of it, or seem to consider it a great inconvenience that it is not one. The Programme of the present Congress is one more proof: The Organizing Committee, "after consultation with eminent Geographers of various countries" (*Invitation Circular*, p. 25), "did not think it necessary to present as a subject for discussion the formation of the *Theory of Geography*. The morphology of the Earth is merely approached as a *Systematic Terminology of Land Forms*."

of the remains of the older ones, those geographers do geological work, just as when geologists study and describe the composition, the direction, the lie, the relative age, and the probable origin of a sediment.

And as, to be complete in their work, geologists must always describe the distribution on Earth of the beings and phenomena which they study, and geographers must always refer to the nature and history of the beings and phenomena they describe, geologists are always, in fact, assuming the position of geographers, as geographers are constantly assuming the position of geologists.

While studying the wear and transportation of rocks by water and air, the opening of new valleys, the filling up of old ones, the changes of course in running waters, the upheaval or subsidence of lands, the composition of the materials before and after the different phenomena, as well as their causes, geographers are geologists.

The circumstance of all the above-mentioned facts having taken place before or after the known existence of man on Earth, or that of their having become known through natural vestiges, or by the evidence of human monuments, can not alter in any way their essential nature: The way in which sands are being formed and cemented now, and the way in which sandstones were formed and cemented in Devonian times, belong both alike to the domain of geologists.

The description of a volcano, or the description of the distribution of all the volcanoes of the present day, or of the volcanoes of the so-called geological ages, belongs entirely to Geography. But the study of a volcano, whether it rises to-morrow or has existed during the Tertiary epoch, belongs to Geology. The description of the distribution on Earth of ancient and extinct biological species (part of Palæontology) is as much Geography as the description of the distribution on Earth of actual living beings (floras, faunas). The latter, indeed, cannot be completely done without the former.

The description of the whole Earth, or the description of a limited locality, in different epochs, is Geography. The study of the evolution, of the transformations, which have successively fixed the features of the whole Earth, or of some of its parts, is Geology. The description of the Earth during Tertiary times is Geography. The study of the formation of actual lands is Geology. Geography describes the distribution of human races, as it describes the distribution of all other animal species, and even the distribution of languages and religions on Earth, but only other sciences study these particular classes of facts in themselves.

Geography merely accepts and describes aspects. Geology investigates the nature of the elements, the evolution of the beings in action, and, therefore, explains.

This is what the words (geography, geology) themselves imply, and what, in my opinion, unbiassed human reason shows when applied to the

two groups of notions at present mixed up, to which the names of "Geology" and "Geography" * are given.

The domains of Geology and Geography are thus perfectly definite—as definite as things can be. But men who chose to be called geologists or geographers find themselves, therefore, by necessity, constantly treading on each other's ground.†

As the classification of sciences must always be made according to rational motives, violence ought not to be done to the nature of things or to human reason, in order to make artificially simple what is naturally complex; or in order to give to A the pleasure of considering himself a strict geologist, or to B the advantage of being looked upon as a pure geographer, persons who, I hope for science's sake, are every day becoming rarer, as both a pure geographer and a strict geologist are, for me, two very incomplete individualities, a pure geographer being nothing more than a superficial geologist, a real geologist being necessarily a deep and complete geographer.

II.

But even a description can become a science, and Geography can become a science, or (if strictly pure Geography) the nearest approach to a science. The only essential condition for the attainment of such a dignity is for Geography to conceive and present its subject as a unity, an individuality, an organic whole.

The work bestowed by men upon a science is always divided into two departments—(1) To ascertain facts through observations and experiments; (2) to bring them into unity, to fuse them into a theory expressing the organic unity of the whole, which is the real object of the science.

Those men who do the first part exclusively are, no doubt, very useful as furnishing the more or less prepared material for the lofty construction. But those who succeed in creating the second, really represent the highest functions of the human mind. It is only, indeed, because the former are indispensable elements for making possible the latter's existence, that they can be considered scientifically productive.

A science is a systematic and rational collection of laws expressing

* The German *Erdkunde*, "knowledge, science of the Earth," must therefore include Geology and Geography in its meaning. Geonomy is synonymous with Geology, as Astronomy would be with Astrology, had not historical associations made the latter expression objectionable.

† I cannot agree with any of the opinions expressed, not long ago (September, 1893), at a special joint meeting of the Geological and Geographical Sections of the British Association (called to settle the point I now briefly discuss), by Messrs. Markham, Topley, Ravenstein, Lapworth, Bonney, Buchanan, Drs. Valentine Ball, Roberts, Mill, Colonel Godwin-Austen, and Sir Archibald Geikie. Some of these gentlemen saw distinctions between Geology and Geography which, in my opinion, do not exist, or are not essential. Others did not see the essential difference which really exists.

the existence of an organic whole. It is only since the physical, chemical, and biological unity of the world was proved, that physics, chemistry, and biology can be considered as sciences.

As the formation of systematic collections of laws, and resultant theories or formulæ of organic wholes, are the consequences of well-ascertained facts, the dominant theories of sciences change from time to time. Every science has been, and no doubt will be still, over and over again constituted and re-constituted anew. But the human mind always needs, when normally organized, to see facts synthetically connected to make a living being, as it were, no matter if the synthetic formula has to be, in future, deeply and essentially altered. All theories are thus working theories. This is what, if not more than that, Geography is sorely in need of.

III.

The importance of having correct descriptions of all parts of the Earth, even in its minutest details, is self-evident: but in the midst of fragmentary studies, of partial explorations of countries, of monographs of localities, it is necessary to remember that, although all this is precious material for scientific constructions, yet none of it is really the science—the plan of the great building to be erected, the individuality to be understood; and that even those partial and preparatory investigations would be pursued with much more profit if those who travel, observe, and describe, while collecting the materials of the building in which they are to be employed, did not lose sight for a moment of the plan of the building itself; while studying an organ, did not lose sight of the organism in which it has functions to discharge—did not lose sight of the fact that it is the supreme mission of the geographer to prove the existence of the Earth as an organic whole, thus creating a real scientific unity with the disjointed and incoherent mass of facts to which the name of Geography has often, up to the present, been applied.

IV.

I am aware that the idea of considering the Earth as an organic unity, as an organism, is not new. I know that some of the organs of that organism have been already recognized and determined in their more evident parts. But I know, too, that the expression of the necessity of a supreme geographical synthesis lies forgotten, or unemployed, in a few publications; that books and books of Geography, Geology, Geonomy, and Physiography, which pretend to give the description of the Earth, the theory of the Earth, the laws ruling the existence of the Earth, continue to be more or less disconnected bundles of facts: that the great majority of men, many of them illustrious, who consider themselves, and are generally considered, scientific geographers, seem to ignore that any formulæ of unity were ever proposed, or, if they

know of their existence, merely think them ingenious and useless curiosities; that geographical teaching, treatises, and popular books of Geography (with partial and few exceptions), all forget to show the children and the general public that the Earth is a rational organism.

The aim of this paper is, therefore, only to revive what I consider of prime importance. And it is merely to make myself clearly understood that I here indicate, summarily, what I suppose to be the principal features of the great construction.

V.

As living beings have to be studied in the several organic systems whose interaction forms their transforming unity, so different unities have to be established in Geography, out of different classes of facts, each one needing to be considered from a special point of view, before they can all be united in the supreme syntheses of the inhabited globe.

Of these unities the first is the morphological-unity of the mineral Earth; the second, the climatic-unity; the third, the biological-unity.

Some of the most genial founders of what I consider to be the real geographical science have, to a certain extent, spoiled their final synthesis by attacking, without sufficient preparation, the problem as a whole, looking simultaneously at its different parts from more than one point of view, and introducing from the very beginning human finality as a criterion.

I only propose to mention, as an instance, the general lines of what has been tried, and might, in my opinion, be already considered as established, on the first of the above unities.

VI.

From the subtlest rarefactions of its gases to the densest of its solids, the Earth may be perhaps, *grosso modo*, considered as concentrically composed of an ethersphere(?) . . . , an atmosphere, a lithosphere . . . , a metalosphere(?), the better known parts thus existing between two zones of hypotheses, which is, in fact, the irremediable situation of all things.

The solid mineral mass of the Earth forming its firmer part and the basis of its structure, is the first class of facts to be considered.

Co-existing with the other beings, along with which it makes part of a superior organism, the Earth's relations as a whole are expressed in being attracted and attracting, thus having its equilibrium, its shape, and its movements determined. The general functions of the great Earth organism are, as everybody knows, to translate, to rotate, to vibrate, to cool, to contract, to condense, to oxidize.

VII.

Were the Earth entirely fluid or plastic, thus opposing the minimum resistance to the forces which act on it, it would be very easy to see, in

the passing shapes assumed by its substances, the consequences of those actions. But a part of the Earth is in fact fluid; and some of the general causes which act on the great masses called seas act on the great masses called solid lands. The former being so-called fluid, and the latter so-called solid, the power of resisting the actions which modify their shapes is, no doubt, different in the two; but nothing compels us to believe that it is *nil* in one case, and absolute in the other. A great error is constantly being made in the sciences which boast of being positive, when they attribute absolute meanings to what can only have relative ones. Nothing can be conceived on Earth as absolutely solid or absolutely motionless. The so-called solid mass of the Earth is only so in relation to the relative fluidity of the water. As a matter of fact, the solid mass of the Earth is relatively fluid, fluid enough to obey the powerful actions which move and mould it.

In the water masses, the consequence of these actions is the evident formation of waves; so it must be in the land masses. Waters, less solid than rocks, rise, fold themselves, form a salient part which falls on a concave one, making a basis for fresh waves, quickly formed and effaced in turn. Rocks or lands, less fluid than waters, do slowly assume the very same forms; but these remain in the whole, or in expressive fragments, for ages, without the general evolution ever coming to an end.

Thus conceived, the fundamental morphology of all the parts of the Earth becomes the natural result of a general law.*

The solid mass of the Earth is therefore differentiated into wavy groups of land, into forms to be accepted as its anatomical elements, which again group themselves as the organs of this skeletonic substructure.

We know that these anatomical elements are waves (or folds), which (being now established in geology, and perfectly determined in all their integrant parts) must be the foundation of all geographical descriptions, as they are of all Earth morphology. They do not need to be described here.

The Earth is a collection of waves as biological organisms are collections of cellules; it is a collection of mountains, plains, valleys, as biological organisms are collections of tissues. The elementary waves, the mountains, plains, valleys which they form, are systematically grouped to constitute organs.

* It has been recently supposed, as is well known, that the orography of the Earth is as it would be in its great lines (from the bottom of seas to the top of mountains) if it were the result of the ancient, actual, and permanent application of a plane of pressure on the so-called *line of mean-sphere level*, the existence of which was assumed to be between 2280 m. and 3000 m. below the present mean sea-level.

VIII.

To have the completest view of the fundamental and organic morphology of the whole Earth, to determine the absolute grouping of all its masses, the relations between its larger waves, and its principal organs, the Earth must be considered in its total orographic features, entirely ignoring the existence of its waters, which, in this case, merely conceal a great part of the fundamental skeleton, and have deeply altered the purity of the tectonic construction.

This is often forgotten by the very founders of what I consider the real geographical science, by the geographical philosophers who discovered the geographical homologies, thus at last essentially determining the organs of the Earth.

The lands rise into two large masses towards the two poles of the ellipsoid.

Although good geographers will not dare any more, I hope, to divide the Earth into a solid and a liquid part, as if the solid had only existence in the portion to be seen above the low tides and the liquid one were not contained in a solid basin with borders and bottom, still the orography of what lies below 2000 m. of the mean level of the seas is very vaguely known. That is why the total orography of the Earth, completely defining its organs, cannot yet be entirely understood.*

The existence of two great circumpolar masses can, however, be already considered as that of two great centres, the two great ganglions (γάγγλιον, "a knot") where meet, or from which start, the arms or ridges whose upper parts are visible above the waters, and are usually called continents and islands.

Between these two great circumpolar ganglions stretch out (a) three great waves, at present dominant, and (b) two great waves (at least), at present subordinate.

The more evident of these waves present a similarity, which not only cannot be considered as essentially fortuitous, because it is impossible, logically, to conceive anything "essentially fortuitous," but because they entirely coincide with each other as the expression of a general law of organic symmetry.

All we know of the morphology, and the direction of the three great dominant waves, down to about 3000 m., shows them to be undeniable organic homologies, symmetrical organs, which by necessity spring from a co-ordinate system of actions. From the causes of (a) subsidence-

* The great regions for discovery in the twentieth century are the two poles and the bottom of the seas. Simultaneously with the great expeditions which, like that of the *Challenger*, will continue to trace the many principal morphological lines which are as yet unknown, it would be necessary to organize others, more like the Admiralty surveys of the different countries, to reveal the topography of the bottom of the sea, drawing, at successive depths, the water-covered slopes of each one of the already known principal orographical regions of the sea-beds.

upheaval, (b) direction, (c) destruction, (d) shape, the consequences, on the upper parts, at least, of the principal waves of the Earth, have been the same.

The three principal great organs, uniting the two orographic ganglions, are (a) America; (b) Europe-Africa; (c) Asia-Australia. The two subordinate great organs may perhaps be called (d) Atlantide, (e) Polynesia.

I shall omit for the present to consider the two last.

IX.

The three principal organs have been already described in many of their most expressive homologies by a few geographers. I shall not repeat all they have said, although in my opinion the comparative anatomy of the Earth-organs needs to be more completely drawn, systematized, shown as coincident, in the nomenclature of the sub-organs, which they possess in common, according to their geonomical functions.

As has been remarked, and should be universally known, each one of these organs is composed of (a) a north member—North America, Europe, Asia; (b) a south member—South America, Africa, Australia; (c) an intermediary depression, or actual Mediterranean articulation.

The composition of the middle Mediterranean articulations is, in all the three organs, entirely equivalent, as all the essential elements of the north and south members are equivalent, and even almost all of their appendices and accidents.

X.

The upper parts of the masses of land, or largest waves, which I am considering as organs of the Earth-organism, are, as everybody knows now, summits of mountains, probably rising on bases which are already raised on even larger foundations. But on the continental or insular summits other waves have been formed, other mountains have arisen—waves on waves, mountains on mountains. But all these waves, of different orders and ages, have arisen according to a permanent law of symmetry.

The general directions of the mountain-mountains are, on the whole, parallel to the general directions shown, at least, in the upper parts of the continent-mountains. Everybody knows that this evidently harmonic system of directions was recognized long ago by geographers and geologists, and that some privileged intelligences (Elie de Beaumont, 1829; W. Lowthian Green, 1873) have further tried to discover its geometrical laws, and the far-reaching consequences to be derived therefrom.

I will merely remark now that these directions are never parallel for any great extent, either to the axis or to the equator of the Earth—never in great north-to-south or east-to-west ranges. The forms of the

organs of the Earth, as well as those of the great waves which rise over them as mountains, are all determined by lines from the north-west to the south-east, and from the north-east to the south-west quadrants—as if at the sides of the axial poles of the Earth there were orogenic poles from which all the waves radiated.

From the zigzags produced by these two dominant directions result all the characteristic and corresponding encounters clearly visible both in the perimeters of the principal continental organs, as in the secondary orographic mountain waves. Identical are the orientations of the axes of all the oceanic depressions between the three more evident organs.

XI.

The inmost, if somewhat unconscious, feeling that the Earth is an individuality, a whole of harmoniously co-ordinate parts, an organism, whose organs must therefore reveal a symmetry and constitute a rational whole, inspired many of the ancient geographers. It was in obedience to this feeling that they took a mathematical conception, or a representative locality, as the criterion or centre of the Earth's symmetry, dividing, geometrically, its known surface, making its natural divisions coincide with regular and rigid forms, thus showing an entirely scientific, philosophic, and essentially truthful state of mind.

From the logical, and therefore necessary, condition of the human intelligence resulted the symmetrical conception of the Greeks—the sea, or river (*ὠκὺς ραῶ*, *oceanus*, “running quick”), circumferent to the known lands (the *oecumenon*) around the Mediterranean; the seas, rivers, and mountains, ranged along the diaphragma and vertical, of Dicaearchus and Eratosthenes; the maps with the sacred temple of the Delphus, the Semitic Paradise, the Saint Sepulchre of Jerusalem, the Saint Kaaba of Mecca, as centres, around which all the countries of the Earth were regularly disposed; the maps from the eleventh to the fifteenth centuries, in which the Earth was divided into two segments, one of them being bisected into equal parts or sectors (Europe and Africa), while the other segment was shown as equivalent to both sectors; or the *terra quadrifida*, where the existence, in the old known world, of symmetrical Mediterranean depressions or articulations between two north and two south members was already recognized.

XII.

The forms of the principal organs of the Earth, and the secondary waves that rise and fold themselves on them, are, of course (as is the case with all beings), the result of the causes which produced them, modified by the actions which tend to destroy them.

To completely realize the morphology of the organs of the Earth, one

ought to begin by studying the first causes, and by thoroughly investigating the second actions only afterwards.

One of the most important and best-known modifying morphological agents in the Earth-organism is water. Each land-wave that rises above the sea becomes, as everybody knows, a basin where the atmospheric condensed waters meet. It may be thus somewhat schematically supposed that each one of the three principal organs of the Earth has been the seat, during the successive phases of its formation, of more or less complex hydrographical basins, (a) on the north members, (b) on the south members, (c) on the median depressions, or Mediterranean articulations, which last are still perfectly evident.

The idea of the existence, on each continental organic member of the Earth, of one or more central lakes, from which rivers ran in opposite directions, is to be found in the traditions of many peoples, partially collected in the works of even sixteenth and seventeenth century geographers, no doubt representing what had once taken place.

The three Mediterranean depressions or articulations have been, and are still now, to a certain extent, three collecting centres for the aqueous condensations of the six north and south members of the three organs respectively.

XIII.

Lakes, formed by the filling up of natural hollows or erosion cavities with the waters condensed on the high lands, emptied themselves, partially or totally, after their fluid contents had broken through, at one point or another, the edge of their hydrographical basins.

Even to-day, in all the members of the organs of the Earth, hydrographical systems, in which the essential lake-phase of all great water-courses has not yet disappeared, are to be seen. The waters have not yet formed, in this case, their fluvial opening. The furrows gradually excavated in the more or less steep slopes, or shallow in the more or less even expanses of land, are the collecting channels of the water condensed on the high surfaces and poured down the inclined planes. Each one of these furrows is a river; rivers are nothing but these furrows.

All this is extremely elementary, and seems, no doubt, stated as it is in a paper presented to a Geographical Congress, childish and useless.

But water is not only an element of disturbance because it deeply alters the fundamental orography of the Earth, but because it imposes itself by its accumulations and courses on the attention of geographers, leading astray their observation and their consequent judgments and descriptions. Although geographers, as a rule, do not feel the otherwise rational and irresistible human necessity of considering Geography as the description of an individuality, or of an harmonious whole, or an organism, still they all deal with rivers as if the latter were living personalities, thus obeying the same instinctive psychological propensities which once

made of them, and in fact of every natural being, so many gods and genii. Thus geographers always call one river what is really a system of channels where the falling waters meet; thus they force one name on what they call one river, when, in the great majority of cases, being many rivers, it ought to have many names; thus irrationally, but gravely, geographers, for instance, investigate if the true Amazonas is the Maranhão or the Ucayale, looking at this imaginary and insoluble problem from different points of view (that of the length of course, that of the quantity of water transported, that of the traditional local opinion), to decide between the different channels of the same system, which is the artificial entity which geographers continue to call the true river; thus geographers investigate the real source of each river, and every day lionized travellers (justly lionized, no doubt, for other reasons,) continue to discover these mythological entities; thus all geographical maps more or less correctly describe the hydrography of the Earth, which is a secondary factor in the Earth-organism, and falsify its real orography, which is the fundamental factor, not making a distinction between the cases in which rivers draw by their courses the organic features of land, from those, much more frequent, in which they entirely alter it.*

XIV.

If, after having synthetically considered the hydrological essential features of the three principal organs of the Earth, we look at the deep oceanic depressions hollowed between them (the Atlantic, the Pacific, the Indian Ocean), we shall easily see that they are but large lakes, actually divided one from the other at a certain depth (from 200 to 2000 m.). Maybe these seas were, in fact, once isolated as lakes (the closed seas of Hipparchus and to a certain extent of Ptolemy), and that the obliteration of the intermediary basin-edges, to establish the necessary hydraulic equilibrium, originated the legend, which still frightened the sailors of the fifteenth century, of a region in the South Atlantic where the ocean waters suddenly fell into a prodigious abyss.

* The ordinary orographical maps, both for the lands above, as well as for those below the sea-level, are formed with equidistant lines of equal altitude at 10, 100, 1000 metres, feet, or fathoms interval, evidently on the supposition—

1. That what we call round numbers have any value in nature apart from being mnemonic and conventionally used;
2. That for all parts of the Earth the same round numbers have the same importance, and can reveal the same essential facts.

It would be necessary to discover for each region the altitudinal lines (represented by round or any numbers) which could express the essential and important orographical facts.

XV.

Water, however, which is a disturbing element in relation to the fundamental formations of the Earth, is otherwise, as everybody knows, an architectural artist in relation to the actual and future earth-structures, as it has been in relation to the successive structures, which express, through the ages, the evolution of the organism I have been considering.

This is why, directly after the determination of the fundamental orogeny of the Earth, it is necessary to discover a formula of unity for the solid Lithosphere in its relation to water and air. From these relations springs, above all, the morphology we at present observe, and the forms of the organs we actually see in action; or, rather, the organs we actually can study are, in fact, the great waves of the solid Earth, after they were worked by the circumferent water and air.

XVI.

Thus, through a great complexity of episodes, the more expressive phases of formation of each one of the organs of the Earth may be summarised in the following terms:—

1. Summits of orographical waves emerging insularly from the sea in lines (ridges) of two dominant general orientations.

2. Co-ordination of orographical waves, forming at last three principal, three articulated emerged organs, and two, at least, partially immersed secondary ones.

3. Condensation of atmospheric waters on the orographical waves.

4. Erosion and denudation of the organic waves; formation of large lacustrine basins.

5. Rupture of the hydrographical continental basins; formation of the great central rivers; drainage of the waters of members north and south of each organ to the intermediate Mediterranean depressions.

6. Alterations and divisions in the course of the continental fluvial waters.

XVII.

I do not forget (as I cannot admire the pure geographers, who only describe what they superficially see, and only know what they describe) that the features we can to-day observe as the forms of the Earth were successively shaped through many incidents. The present geographical physiognomy of the Earth can only be perfectly understood whenever the description of geographical physiognomies of the Earth, at the successive epochs of its existence, will become possible. The actual Earth organism, with its co-ordination of organs and its plan of symmetry, is one being which comes from anterior ones, having had differently co-ordinated organs, and having possibly realized other plans of symmetry. There must be, however, between them a necessary law of harmony.

Whatever may be the epochs in which they were gradually formed, and the gaps that, during long times, existed in their full definition, the correspondent and equivalent features in the three principal organs of the Earth-organism were symmetrically worked out. Mountain ridges, following a parallel direction to the organic continents, fragments of what we now call "the same mountain ridge," did come to range beside each other, to occupy, in the same symmetrical plan, places which seemed to have been destined for them beforehand.

XVIII.

But the organs of the Earth-organism, as they are such, are active instruments (*ὄργανον*) of functions. These functions are, as in all beings, to grow, to waste, to be transformed.

The Earth-organism being considered in its first unity of mineral mass surrounded by air and water, we see that the two polar ganglions and the three or five equivalent organs which rise between them have slowly grown up as waves, and more quickly have fallen into ruins, with which, out of the old morphological formulæ, a new complex structure is continually rising, as the present organism came out of successive palæontological worlds.

XIX.

But all this is merely the general lines which show the unity of the Earth-osteology, and therefore only a part of the problem.

The whole problem may perhaps be formulated in the following terms: Given (1) the Earth, composed of certain mineral matters, affecting certain shapes; in contact (2) partially with liquid water and dissolved air; (3) partially with gaseous and liquid water with free and dissolved air; (4) under the action of regional temperatures; (5) and certain movements (general ones, local dislocations, and subtle vibrations—magnetic, electric); the final resultant is: Special condensations of mineral matter, creating intermediate states between the liquid and the solid ones, producing living beings, which are distributed over the Earth in harmony with the conflicting circumstances in which they are produced. The organs of the Earth acquire, from this point of view, latitudinal and altitudinal features.

On these foundations the supreme and final unity of the complete Earth organism must be established.

XX.

One of the proofs that shows how instinctively the human mind needs to realize rational groups of ideas, unities, organic beings, is that they are essentially mnemonic.

Let us consider the Earth as an organic whole; let us make

Geography the anatomical and functional description of its organs; let us present them as parts of an organism acting harmoniously, and we shall see the educational value it acquires, the facility with which it will be accepted, and how deeply the features of the new being will remain impressed on the popular memory.

This is why I would like to see, as the foundation of all school or popular books of Geography, the Earth described as an organism, and its organs comparatively studied.

As I have said already, very little, if anything, is new in the ideas expressed in this paper. What is unusual is to express them in their intimate connection.

The aim of this paper is precisely, as I said before, to call the attention of geographers to them. In one of his best Presidential addresses (November, 1893) to the Royal Geographical Society, the illustrious President of the present Congress, Mr. Clements R. Markham, enumerates what he considers the "*geographical desiderata*" of the present day. These are all about collecting materials for the formation of the science of Earth. The formation of the synthesis which has to constitute the theory of that science is not to be found among those *desiderata*.

What is essential in this paper is the assertion that, to be a science, Geography must consider the Earth as an organic whole.

What is possibly transitional in it is the formula I propose, after others, as the expression of the Earth-organism.

Let us have it discussed, may be entirely dismissed as wrong, but in this case substituted by a better one.

Mr. JAMES MOWATT congratulated Mr. Batalha-Reis on his paper.

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